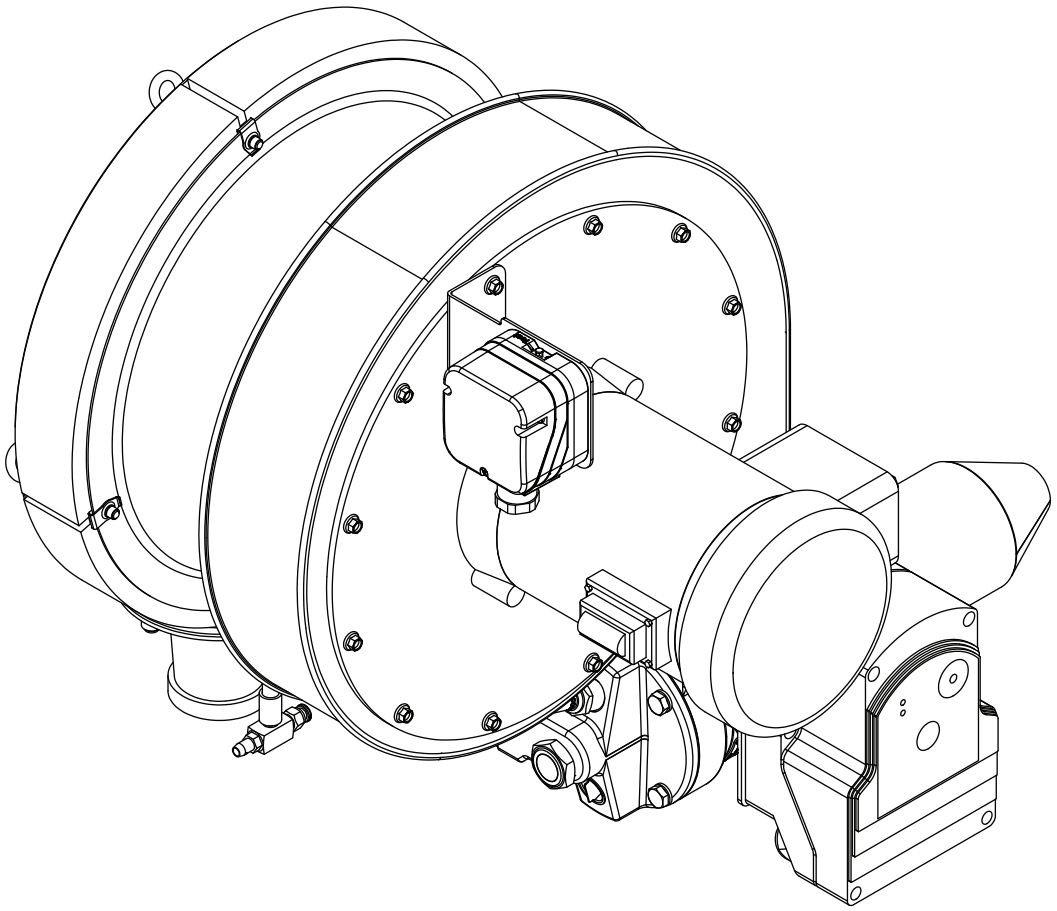
Eclipse RatioAir Burners

Model RA0025 - 2000

Operating Instructions Edition 09.15

Version 3



elster
Thermal Solutions

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Any operation expressly prohibited in this manual, any adjustment, or assembly procedures not recommended or authorized in these instructions shall void the warranty.

Document Conventions

There are several special symbols in this document. You must know their meaning and importance.

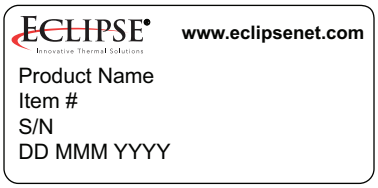
The explanation of these symbols follows below. Please read it thoroughly.

How To Get Help

If you need help, contact your local Eclipse representative. You can also contact Eclipse at:

1665 Elmwood Rd.
Rockford, Illinois 61103 U.S.A.
Phone: 815-877-3031
Fax: 815-877-3336
http://www.eclipsenet.com

Please have the information on the product label available when contacting the factory so we may better serve you.



	This is the safety alert symbol. It is used to alert you to potential personal injurt hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.
	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Is used to address practices not related to personal injury.
NOTE	Indicates an important part of text. Read thoroughly.

Table of Contents

Introduction 1

Product Description

The RatioAir is a nozzle-mix type burner designed for direct and indirect air heating in a wide range of applications including:

- Industrial Ovens and Furnaces
- Glass Lehrs
- Indirect Fired Air Heaters
- RTO Incinerators
- After Burners
- Galvanizing Kettles
- Waterbath Vaporizers

The burner package includes a combustion air blower and an air/gas ratio regulator to fire over a wide gas turndown range with controlled ratio. RatioAir burners are available with three different outlet tube velocity characteristics (standard, medium and high velocity), and are capable of outlet speeds of 250 ft/s with the medium velocity and 500 ft/s with the high velocity tubes.

The burner is designed for:

- Efficient Ratio Controlled Combustion
- Reliable Burner Operation
- Simple Burner Adjustment
- Direct Spark Ignition
- Multiple Fuel Capability

A wide variety of options and configurations are available due to the modular design of the burner.

Audience

This manual has been written for people who are already familiar with all aspects of a nozzle-mix burner and its add-on components, also referred to as “the burner system”.

These aspects are:

- Installation
- Use
- Maintenance

The audience is expected to have previous experience with this type of equipment.

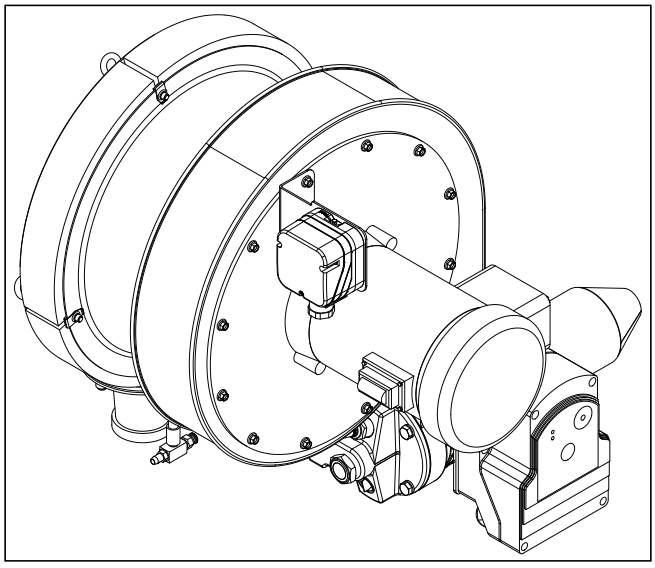


Figure 1.1 RatioAir Burner

RatioAir Documents

Installation Guide No. 115

- This document

Datasheet, Series 115

- Available for individual RA models
- Required to complete design and selection

Design Guide No. 115

- Used with Datasheet to complete installation

Related Documents

- EFE 825 (Combustion Engineering Guide)
- Eclipse Bulletins and Info Guides: 710, 732, 760, 818, 830, 832, 852, 854, 856, 610, 820, 930

Purpose

The purpose of this manual is to ensure the installation and adjustment of a safe, effective and trouble-free combustion system.

Safety

2

Important notices which help provide safe burner operation will be found in this section. To avoid personal injury and damage to the property or facility, the following warnings must be observed. All involved personnel should read this entire manual carefully before attempting to start or operate this system. If any part of the information in this manual is not understood, contact Eclipse before continuing.

Safety Warnings

⚠ DANGER

- **The burners, described herein, are designed to mix fuel with air and burn the resulting mixture. All fuel burning devices are capable of producing fires and explosions if improperly applied, installed, adjusted, controlled or maintained.**
- **Do not bypass any safety feature; fire or explosion could result.**
- **Never try to light a burner if it shows signs of damage or malfunction.**

⚠ WARNING

- **The burner and duct sections are likely to have HOT surfaces. Always wear the appropriate protective equipment when approaching the burner.**
- **Eclipse products are designed to minimize the use of materials that contain crystalline silica. Examples of these chemicals are: respirable crystalline silica from bricks, cement or other masonry products and respirable refractory ceramic fibers from insulating blankets, boards, or gaskets. Despite these efforts, dust created by sanding, sawing, grinding, cutting and other construction activities could release crystalline silica. Crystalline silica is known to cause cancer, and health risks from the exposure to these chemicals vary depending on the frequency and length of exposure to these chemicals. To reduce the risk, limit exposure to these chemicals, work in a well-ventilated area and wear approved personal protective safety equipment for these chemicals.**

NOTICE

- **This manual provides information regarding the use of these burners for their specific design purpose. Do not deviate from any instructions or application limits described herein without written approval from Eclipse.**

Capabilities

Only qualified personnel, with sufficient mechanical aptitude and experience with combustion equipment, should adjust, maintain or troubleshoot any mechanical or electrical part of this system. Contact Eclipse for any needed commissioning assistance.

Operator Training

The best safety precaution is an alert and trained operator. Train new operators thoroughly and have them demonstrate an adequate understanding of the equipment and its operation. A regular retraining schedule should be administered to ensure operators maintain a high degree of proficiency. Contact Eclipse for any needed site-specific training.

Replacement Parts

Order replacement parts from Eclipse only. All Eclipse approved valves or switches should carry UL, FM, CSA, CGA and/or CE approval where applicable.

Installation

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In this section you will find information and instructions needed to install the burner and system components.

Handling & Storage

NOTICE

- **When refractory combustion block is supplied with the burner, it is critical that the instructions for handling and storage are followed. The refractory should be considered fragile; improper handling and storage will cause premature failure.**

Handling

- Inspect the system, being sure the components are clean and free of damage.
- Use the appropriate support and handling equipment when lifting the burner.
- Protect all components on the system from weather, damage, dirt and moisture.
- Protect the system and its components from excessive temperatures and humidity.

Storage

- Make sure the components are clean and free of damage.
- Store the components in a cool, clean, dry room.
- Keep all system components in their original packaging as long as possible

Approval of Components

Limit Controls & Safety Equipment

All limit controls and safety equipment must comply with all applicable local codes and/or standards and must be listed for combustion safety by an independent testing agency. Typical application examples include:

- American: NFPA 86 with listing marks from UL, FM, CSA
- European: EN 746-2 with CE mark from TuV, Gastec, Advantica

Electrical Wiring

All the electrical wiring must comply with all applicable local codes and/or standards such as:

- NFPA Standard 70
- IEC60364
- CSA C22
- BS7671

Gas Piping

All the gas piping must comply with all applicable local codes and/or standards such as:

- NFPA Standard 54
- ANSI Z223
- EN 746-2

Where to Get the Standards:

The NFPA Standards are available from:
National Fire Protection Agency
Batterymarch Park
Quincy, MA 02269
www.nfpa.org

The ANSI Standards are available from:
American National Standard Institute
1430 Broadway
New York, NY 10018
www.ansi.org

The UL Standards are available from:
333 Pfingsten Road
Northbrook, IL 60062
www.ul.com

The FM Standards are available from:
1151 Boston-Providence Turnpike
PO Box 9102
Norwood, MA 02062
www.fmglobal.com/approvals

Information on the EN standards and where to get them is available from:

Comité Européen de Normalisation
Stassartstraat 36
B-1050 Brussels
Phone: +32-25196811
Fax: +32-25196819
www.cen.eu

Comité Européen de Normalisation Electronique
Stassartstraat 36
B-1050 Brussels
Phone: +32-25196871
Fax: +32-25196919
www.cenelec.org

Checklist Before Installation

Air Supply

Provide an opening in the burner room of at least one square inch per 4000 BTU/hr (6 cm^2 per 1 kW) to supply the burner intake with fresh, outdoor, combustion air.

If there are corrosive fumes or materials in the surrounding air, find an uncontaminated source to supply air to the burner, or provide a sufficient air filtering system.

Exhaust

Do not allow exhaust fumes to accumulate in the work area. Provide some positive means for exhausting from the furnace and the building.

Access

Make sure the burner is installed in such a way to allow easy access for inspection and maintenance.

Environment

Make sure the local environment matches the original operating specifications. Check the following items:

- Voltage, frequency and stability of the electrical power
- Fuel type and supply pressure of the fuel
- Availability of enough fresh, clean combustion air
- Humidity, altitude and temperature of air
- Presence of damaging corrosive gases in the air
- Prevent direct exposure to water

Installing the Flame Sensor

1. Install the flame sensor into the 1/2" NPT opening in the rear cover.

2. Make sure the flame sensor of a burner is connected to the electrical circuit for that burner.

⚠ DANGER

- **If you connect the flame sensor of a burner to the electrical circuit of the wrong burner, you can cause fires and explosions.**

There are two different types of flame sensors; UV scanner and flamerod.

UV Scanner

For detailed information on how to install and connect a UV scanner, refer to scanner information guide.

Flame Rod

NOTE: Only specific burner sizes with alloy or silicon carbide combustors can use a flamerod (see specific burner datasheets).

For detailed information on how to install and connect a flamerod, refer to Bulletin/Info guide 832.

Installing the Spark Plug

Install the spark plug into the opening in the rear cover.

NOTE: Do ***not*** apply any grease to the threads of the spark plug. You can cause inadequate grounding of the spark plug if you apply grease to it. Poor grounding of the spark plug results in a weak spark.

NOTICE

- **Adjustments may vary from Eclipse published values if the flame controls other than those recommended in the Design Guide are used. Consult with the engineer who specified the alternate control for limitations.**

Burner Installation

Chamber Opening

Provide an opening in the chamber wall at least 1/2" (12mm) larger in diameter than the outside diameter of the combustor, or 1/2" (12mm) larger in height and width than the refractory block (1/4" - 6mm per side). Refer to the Chamber Opening diagram.

Provide an accessible pressure tap on the chamber wall to measure the pressure inside the firing chamber. The pressure tap should be located near the burner.

Mounting Pattern

Attach mounting bolts to the chamber wall. Position these bolts to match the clearance holes **"C"** on the burner mounting flange. Refer to the appropriate RatioAir datasheet.

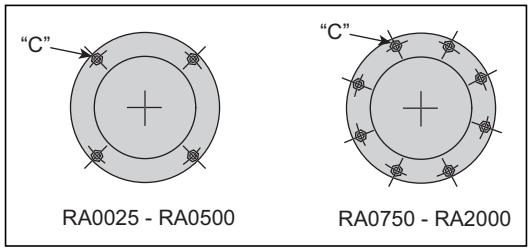

Figure 3.1. Mounting Pattern

Chamber Wall

Make sure the chamber wall is strong enough to support the weight of the burner. If necessary, reinforce the mounting area. Refer to the Chamber Wall and Mounting Pattern diagrams.

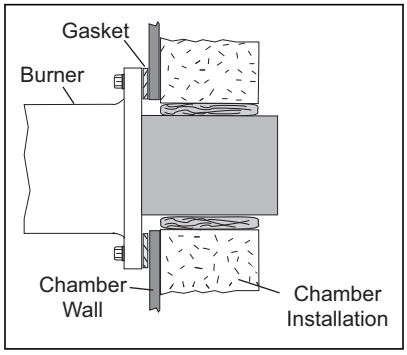

Figure 3.2. Chamber Wall

Refractory furnace walls must allow for thermal expansion as recommended by the refractory supplier - the wall should apply no stress on the burner block or refractory layer surrounding the burner block. Expansion joints built into the furnace wall should permit the furnace shell, burner block holder, combustor or burner block and surrounding refractory to move as a unit in the event of unequal expansion of the refractory wall and furnace shell.

The combustor or combustion block must not extend beyond the inside of the furnace wall more than 1" (24mm). Beyond this length it is necessary to add a spacer on the outside of the furnace to keep the end of the combustor or combustion block within 1/2" (12mm) of the inside furnace wall.

If the combustor or burner block is shorter than the furnace wall thickness the block or combustor should be recessed into the wall. To prevent refractory overheating, a 45° chamber should be applied.

Burner Mounting

Mount burner to chamber wall using customer supplied nuts and lock washers.

Alloy Combustor (Figure 3.3)

1. Ensure the gasket ❶ is installed between the burner and the chamber wall ❷.
2. Ensure that gasket ❶ does not leak.
3. Check the size of the clearance. If the gap ❸ around the firing tube is larger than 1/2", then pack the gap with ceramic fiber ❹.

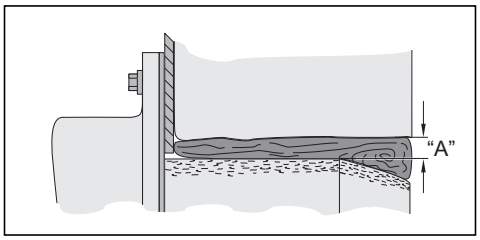

Figure 3.3. Alloy Combustor

Silicon Carbide (SiC) Combustor Only (Figure 3.4)

Ensure the gasket ❶ is installed between the burner flange and chamber wall ❷.

1. Ensure gasket ❺ is installed between SiC tube and flange ❻.
2. Ensure neither gaskets ❶ nor ❺ leaks.
3. Check the size of the clearance. If the gap around the firing tube is larger than 1/2", pack the gap with ceramic fiber ❹.

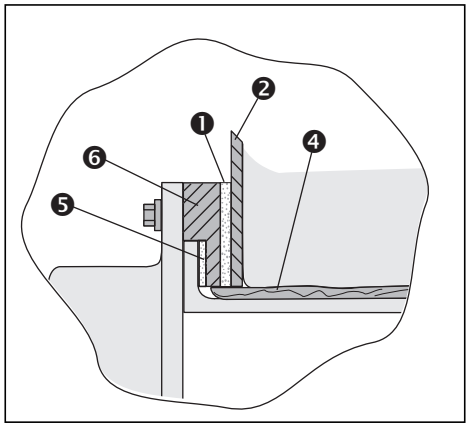

Figure 3.4. Silicon Carbide

Refractory Block (Figure 3.5)

1. Ensure gasket ❶ is installed between burner ❸ and block holder ❹.

2. Ensure gasket ❺ is installed between block holder ❹ and chamber wall ❷.

3. Support the weight of refractory block ❻ with hard brick work anchored to the furnace shell ❼. Fill the 1/2" space between block ❻ and the three unsupported sides with soft gasket material ❽.

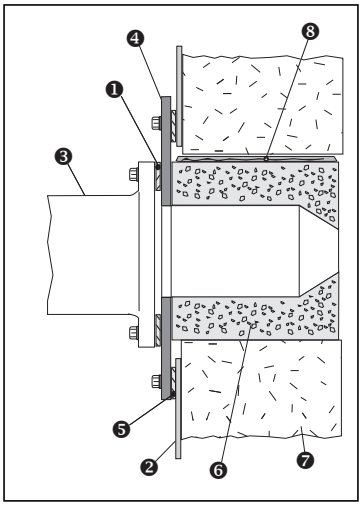

Figure 3.5. Refractory Block

Large Refractory Blocks

On sizes RA0500 thru RA2000; the block must be tightly surrounded by a collar made of brick, plastic refractory, or a castable refractory of at least 4" (10 cm) minimum thickness on all sides of the block. If the collar is cast around the block, a thin plastic film (i.e. Saran Wrap® or Glad Wrap®) should be wrapped around the block to keep moisture from leaching into it. The collar should be anchored to the furnace shell with suitable anchors and must be constructed to rest on a surface capable of supporting its weight, such as a hearth or a solid refractory or brick wall. For furnaces that are unable to support the weight of the refractory block, a stainless steel shelf can be welded to the shell to support the collar.

NOTE: All refractory blocks are cured at a minimum temperature of 550°F (300°C) prior to shipment.

NOTE: The correct insulation of burner combustion blocks in furnaces results in longer block life and adds value by reducing downtime and maintenance.

Block Holder Temperature

Excessive block holder temperatures can cause problems. Overheating can be reduced by carefully sealing the burner blocks in the wall to prevent the leakage of hot gases back to the furnace shell.

In high temperature (>1,400°F, 760°C) fiber-wall furnace installations, the length of the metallic wrapper should extend no farther than the point in the wall where the interface temperature is higher than 1800°F (760°C).

Vertical Down Firing Blocks (Figure 3.6)

1. Down firing blocks may be suspended by customer supplied hangers ❷ attached to the burner body mounting bolts.

2. Hangers should be attached to structural support ❶.

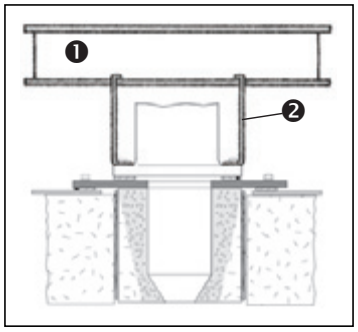

Figure 3.6. Vertical Down Firing Block

Gas Piping

Burner Piping

The burner is factory assembled and shipped as ordered.

NOTE: If it is necessary to redirect piping, be sure the:

- ratio regulator spring column ❶ is pointing down.
- arrow on the ratio regulator points in the direction of gas flow.
- integral fuel orifice and o-rings ❷ are re-installed in the same orientation with respect to the fuel flow.
- same straight run of pipe ❸ remains between the ratio regulator and the burner.

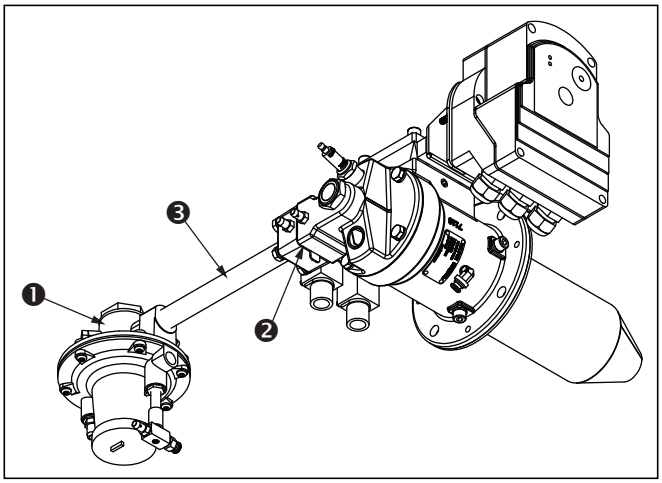

Figure 3.7. Burner Piping

Supply Piping

Inlet pressure to the ratio regulator must stay within specified limits. Refer to the appropriate RatioAir datasheet.

- Locate the valve train close to the burner. The gas must reach the burner during the fixed trial for ignition.
- Appropriately size shut off valves in the valve train.
- Make sure piping is large enough to accommodate flow required to meet burner input.
- Minimize piping elbows.

Bypass Start Gas Piping (Optional)

Install the piping as shown in the schematics using the following guidelines:

- Locate the bypass start gas solenoids ❶ close to the burner. The gas must reach the burner during the trial for ignition period.
- Minimize piping elbows.
- Install an adjustable limiting orifice (ALO) ❷ for start gas adjustment. Refer to Bulletin 728 and 730 for further information.
- Include a straight run of pipe at least 8" (192mm) long ❸ before (upstream from) the start gas orifice ❺ (optional) and at least 4" (96mm) long ❹ after (downstream from) the start gas orifice.

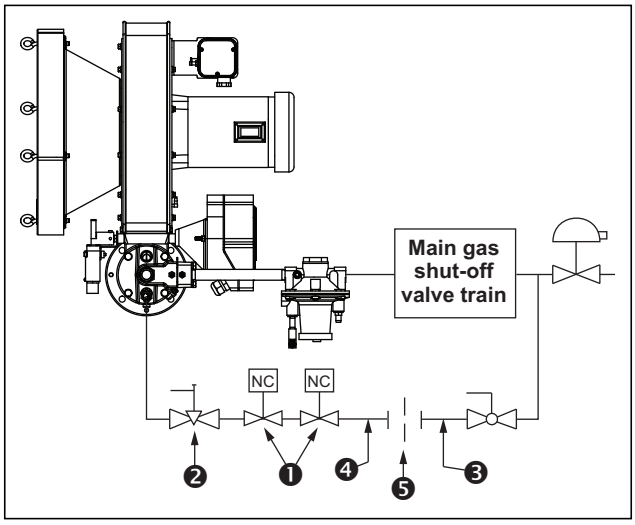

Figure 3.8. Bypass Start Gas Piping

NOTICE

- **This is an example. Please verify that piping complies with all applicable codes and/or standards.**

Pipe Connections

- Installation of a pipe union in the gas line is recommended to simplify burner removal.
- Use of flexible pipe is optional.

NOTE: Flexible pipe causes higher pressure drops than standard pipe. Consider this when sizing your gas lines.

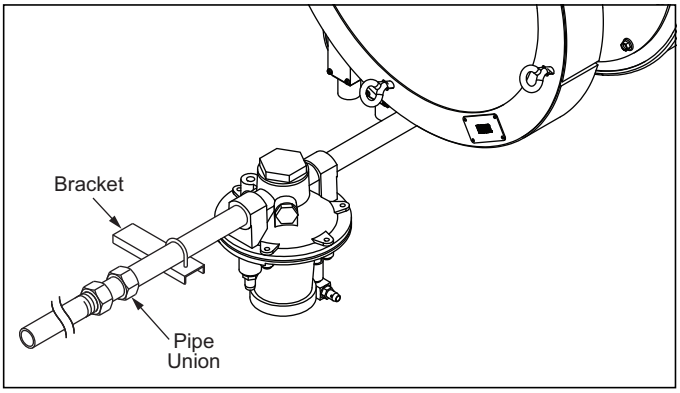

Figure 3.9. Piping Connections

Piping Support

Use brackets or hangers to support the gas piping. If you have questions, consult your local gas company.

Control Motor

Install a control motor to modulate the air butterfly valve if not previously installed on the burner.

NOTE: Be sure the control motor shaft and air butterfly valve shaft are aligned properly. In some cases washers may be used as shims (stacked 0, 1, or 2 high) to ensure proper alignment. Additionally, a flexible coupling can be used to handle minor misalignment.

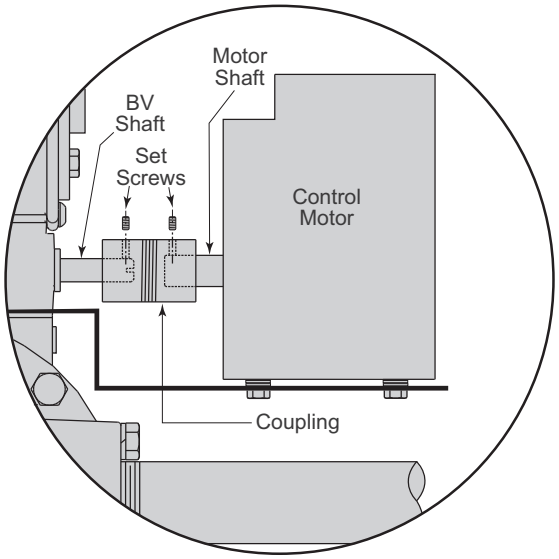

Figure 3.10. Control Motor Mounting

Checklist After Installation

To verify the system was properly installed, perform the following checks:

1. Be sure there are no leaks in the gas lines.

2. Be sure all the components contained in the flame monitoring and control system are properly installed. This includes verifying that:
   - all the switches are installed in the correct locations.
   - all wiring, pressure, and impulse lines are properly connected.

3. Be sure all components of the spark ignition system are installed and functioning properly.

4. Be sure the blower rotates in the proper direction. If the rotation is incorrect, have a qualified electrician rewire the blower to rotate in the proper direction.

5. Be sure all valves are installed in the proper location and correctly oriented relative to the flow direction.